AN 1995:169769 CAPLUS <<LOGINID::20070411>>
DN 122:21806
TI Cu alloy connectors for electric- and electronic apparatus
IN Suzuki, Takeshi; Futatsuka, Rensei; Kumagai, Seiji
PA Mitsubishi Shindo KK, Japan
SO Jpn. Kokai Tokkyo Koho, 9 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 06228684	A	19940816	JP 1993-42031	19930205
	JP 3413864	B2	20030609		
PRAI	JP 1993-42031		19930205		

AB The connectors are Cu alloys containing Zn >3 and ≤35, Ni 0.1-3, Si 0.02-1, Sn 0.01-0.9, Fe 0.007-0.25, P 0.001-0.2, Mg 0.001-0.2 and/or Ca 0.001-0.05, and optionally Pb 0.001-0.01 weight%. The connectors have excellent solderability and inhibits discoloration of the Sn coating at high temperature

---

FULL CONTENTS

[Claim(s)]
[Claim 1] By weight %, Zn:3 ** -35%, nickel:0.1-3%, Si:0.02-1%, Sn: 0.01-0.9%, Fe: 0.007 to 0.25% P:0.001 to 0.2%, an implication -- further -- Mg:0.001-0.2% Ca:0.001-0.05% and ** -- connector for the product electrical and electric equipment made from a Cu alloy characterized by the remainder consisting of Cu alloys which have the composition which consists of Cu and an inevitable impurity including one sort or two sorts.
[Claim 2] By weight %, Zn:3 ** -35%, nickel:0.1-3%, Si:0.02-1%, Sn: 0.1-0.9%, Fe: 0.007 to 0.25% P:0.001 to 0.2%, It is Mg:0.001-0.2% to an implication and a pan. Ca : 0.001 to 0.05%, ** -- the connector for the product electrical and electric equipment made from a Cu alloy characterized by the remainder consisting of Cu alloys which have the composition which consists of Cu and an inevitable impurity further including Pb:0.001-0.01% including one sort or two sorts.

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the connector for the product electrical and electric equipment made from a Cu alloy to which it excels in soldering nature and discoloration of Sn plating does not take place easily under hot environments.
[0002]
[Description of the Prior Art] It is (% shows weight % hereafter) at weight % as a connector for the product electrical and electric equipment made from the former and a Cu alloy, Zn: 0.1-3%, nickel:0.5-3%, Si : 0.08 to 0.8%, Sn: 0.1-0.9%, Fe: 0.007 to 0.25% P:0.001 to 0.2% is contained, and

the connector for the product electrical and electric equipment made from a Cu alloy which consists of Cu alloys with which the remainder has the composition which consists of Cu and an inevitable impurity is known (refer to JP,H3-56636,A).

[0003]

[Problem(s) to be Solved by the Invention] [however, the above-mentioned conventional connector for the product electrical and electric equipment made from a Cu alloy] Zn: Since the Zn content of inclusion consists of few Cu alloys 0.1 to 3% (1) [even if it performs Sn plating to the surface, in order to discolor if put under hot environments, and for contact resistance to increase and to prevent this, it is necessary to use the Cu alloy made to contain exceeding Zn 3% but, and], [Zn / the Cu alloy added exceeding 3%] from the place where soldering nature is bad Zn : As for the connector for the product electrical and electric equipment made from a Cu alloy included exceeding 3%, soldering nature is spoiled. (2) Wear of the metallic mold was intense, the metallic mold life had to become short, maintenance exchange of a metallic mold had to be performed [it had to face performing stamping, especially high-speed stamping and manufacturing a connector, and] frequently, and the technical problem of a manufacturing cost rising occurred.

[0004]

[Means for Solving the Problem] Then, [the person etc.] as a result of this invention person's etc. inquiring that this technical problem should be solved, even if it is the Cu alloy which contained Zn exceeding 3% Mg: 0.001-0.2%, Ca : if a connector is produced with the Cu alloy which added two of one sort or 0.001 to 0.05% of sorts, and added Pb:0.001-0.01% if needed further The knowledge that it could be rare to discolor even if it does not spoil soldering nature which is looked at by the conventional connector and Sn plating is put under hot environments, and for contact resistance to increase, and wear of a metallic mold could be further decreased on the occasion of high-speed stamping was acquired.

[0005] This invention is made based on this knowledge, and Zn:3 ** -35%, nickel: 0.1-3%, Si:0.02-1%, Sn : 0.01 to 0.9%, Fe: 0.007 to 0.25% P:0.001 to 0.2% is contained. Furthermore, Mg: 0.001 to 0.2% Ca : 0.001 to 0.05%, ** -- including one sort or two sorts, further, Pb:0.001-0.01% is contained and the remainder has the feature if needed in the connector for the product electrical and electric equipment made from a Cu alloy constituted from a Cu alloy which has the composition which consists of Cu and an inevitable impurity.

[0006] The Reason which limited next the component composition of the Cu alloy used for manufacture of the connector for electrical and electric equipment of this invention like the above is explained.

[0007] (a) When ZnZn is added exceeding 3%, it has the operation which prevents discoloration of Sn plating under hot environments, and suppresses the increase in contact resistance, but spoil soldering nature. However, Mg:0.001-0.2% and Ca: Addition of two of one sort or 0.001 to 0.05% of sorts will not spoil the above-mentioned soldering nature.

[0008] On the other hand, if Zn is added exceeding 35%, cold working nature worsens, and since a lug crack comes to occur, the reliability as a connector raw material will become inadequate.

therefore, a Zn content -- more than 3% -- it set to -35%.

[0009] (b) nickel and Si -- [both / these / components] although it dissolves on foundation in part [while most raises intensity much more, without joining mutually together, forming and having a compound and spoiling conductivity substantially, there is an operation which raises softening temperature and raises heat creep characteristics, but] If the improvement effect of a request to said operation is not acquired for those content less than [nickel:0.1%] and less than [Si:0.02%], respectively but the content, on the other hand, exceeds nickel:3% and Si:1%, respectively Since hot-rolling nature and the heating adhesion of plating came to have fallen, those content was defined to nickel:0.1-3% and Si:0.02-1%.

[0010] (c) although a SnSn component has the operation which dissolves on foundation and raises intensity, spring nature, and bending nature much more The effect of the request [at less than 0.01%] of the content to the above-mentioned operation was not acquired, but since conductivity came to have fallen on the other hand when the content exceeded 0.9%, the content was defined to 0.01 to 0.9%.

[0011] (d) although a FeFe component has the operation which raises the reliability of a terminal and a connector through the effect of miniaturizing and having the compound deposit of nickel and Si and raising intensity and plating heating adhesion The effect of the request [at less than 0.007%] of the content to the above-mentioned operation was not acquired, but on the other hand, when the content exceeded 0.25%, since hot-rolling nature came to have fallen, the content was determined as 0.007 to 0.25%.

[0012] (e) although PP component has the terminal which controlled lowering of the spring nature which happens by bending, and was therefore carrying out the fabricating operation, and the operation which raises the holding power of a connector The effect of the request of the content at less than 0.001% was not acquired, but on the other hand, since it came to have spoiled plating heating adhesion while reducing hot-rolling nature, when the content exceeded 0.2%, the content was determined as 0.001 to 0.2%.

[0013] (f) Mg and Ca -- [the component of these] Although there is an operation which controls the hot-rolling crack by the segregation of solidification distortion promoted by enlargement of an ingot and S, and other impurity elements etc., and raises stamping nature, raises metallic mold-proof abrasiveness, and raises soldering nature by coexisting with Zn exceeding 3 more% If Ca is added exceeding 0.05% by not acquiring the effect of a request [at less than 0.001%] of the content to the above-mentioned operation, but on the other hand Mg exceeding 0.2% in any case Since an oxide becomes is easy to be involved in, a casting defect increases, a hot-rolling crack will occur if an ingot with this casting defect is hot-rolled, and conductivity is spoiled, it is not desirable. Therefore, the content of Mg and Ca was defined to Mg:0.001-0.2% and Ca:0.001-0.5%, respectively.

[0014] (g) [PbPb] although PbPb is a component which raises stamping nature The effect of the request of the content at less than 0.001% was not acquired, but since it becomes easy to generate a crack at the time of hot-rolling and the slit deletion portion increased on the other hand when contained exceeding 0.01%, the Pb content was determined as 0.001 to 0.01% from the place which

is not desirable.

[0015]

[Example] The Cu alloy of the component composition shown in Table 1 - 3 in the atmosphere and under charcoal covering, respectively is ingoted using the usual low frequency slot type fusion furnace, and it is a semi-continuous casting method, Thickness: The ingot with a size (160mm, width:450mm, and length:2400mm) was produced, subsequently, hot-rolling was started at a predetermined temperature within the limits of 750-950 degrees C, this ingot was used as the thickness:10mm hot-rolling plate, and facing of up-and-down both sides was carried out every 0.5mm after water-cooling. The number of side edge part cracks of 5mm or more and the length of the maximum side edge part crack were visually observed covering hot-rolling plate full length at the time of this facing, that result was shown in Table 4 - 6, and hot-rolling nature was evaluated.

[0016] The hot-rolling plate with the above-mentioned maximum side edge crack should carry out the slit of the side edge part so that the maximum side edge crack is lost. After the hot-rolling plate which removed and was not able to discover a side edge part crack visually further also carries out facing of the both-sides end every 3mm, seeing insurance, Carry out by repeating cold rolling and annealing on condition of usual, and it is considered as a thickness:0.3mm bar with 75% of finishing rolling. By annealing on condition of maintenance for 1 hour at this bar to the predetermined temperature within the limits of 200-500 degrees C, the connector raw material made from this invention Cu alloy (It is hereafter called this invention connector raw material) The connector raw material made from a Cu alloy (conventionally henceforth a connector raw material) was produced 1-19, the connector raw materials 1-8 made from a comparison Cu alloy (henceforth a comparison connector raw material), and conventionally.

[0017] In addition, one quantitative formula of the composition components has the composition from which it separated from the range of this invention, and each comparison KONEKU raw material attached and showed * mark to the composition from which it separated in Table 2 - 3.

[0018] Thus, the obtained this invention connector raw materials 1-16, the comparison connector raw materials 1-8, and the examination of the following [raw material / connector] conventionally were done, soldering nature, metallic mold abrasiveness, and the thermochromism of Sn plating were investigated, and these results were shown in Table 4 - 6.

[0019] (1) Soldering nature examination thickness : size (0.3mm, width:15mm, and length:80mm) Acetone degreasing was carried out, pickling of the test piece which it had was carried out with sulfuric acid 10%, flush dryness was carried out, and it processed by rosin flux, and during the solder bath of a temperature:230 degree C 60%Sn-40%Pb alloy, in the 40mm depth, it was immersed for 5 seconds and pulled up. The wet area of the solder in this case evaluated soldering nature "good" and less than 95% for 95% or more as soldering nature "defect."

[0020] (2) Use the metallic mold made from WC group cemented carbide (Co:16% inclusion) of metallic mold abrasion test marketing by stamping, and it is press blanking about a diameter:2mm circular hole to the various above-mentioned bars. Since the bore diameter which ends 1 million pieces and is formed in a bar in this case is byway-ized as a metallic mold is worn out The variation of

the first bore diameter and the last bore diameter was divided by 1 million, the average rate of change was searched for, the average rate of change of the Cu-alloy strip was conventionally set to 1 among this average rate of change searched for, and it evaluated in quest of the relative rate over this. Therefore, it is shown that it is the bar which does not wear a metallic mold, so that an average rate of change is small.

[0021] (3) Produce the test piece which has a size (thickness:0.30mm, width:50mm, and length:100mm) using the discoloration examination and the adhesion test above-mentioned various bars by heating of Sn plating, and it is an electroplating method usual to this. Thickness: 2-micrometer Sn plating was performed, this test piece by which Sn plating was carried out was heated at 160 degrees C for 200 hours, the existence of the black discoloration color after heating was observed visually, and the thermochromism of Sn plating was investigated.

[0022] Subsequently, width:15mm from each test piece after the above-mentioned heating, length: The size of 80mm The test piece which it had was cut down, 180-degree adhesion bending was carried out about them, it carried out on the conditions returned 180 degrees again, the existence of the plating exfoliation in this 180-degree bending part was observed, that result was shown in Table 4 - 6, and the heating adhesion of Sn plating was evaluated.

[0023]

[Table 1]

種別		成分組成（重量%）									
		Zn	Ni	Si	Sn	Fe	P	Mg	Ca	Pb	Cuおよび不可避不純物
本発明コネクタ素材	1	3.10	1.83	0.46	0.82	0.063	0.011	0.1815	-	-	残
	2	3.83	1.03	0.24	0.12	0.023	0.004	0.0103	-	-	残
	3	4.29	2.91	0.83	0.12	0.220	0.168	0.0075	-	-	残
	4	6.72	1.05	0.26	0.31	0.027	0.007	0.0075	-	-	残
	5	10.11	2.02	0.51	0.19	0.008	0.002	0.0035	-	-	残
	6	12.34	0.97	0.24	0.29	0.031	0.006	0.0103	-	-	残
	7	14.98	0.16	0.03	0.02	0.015	0.052	0.0018	-	-	残
	8	19.23	0.95	0.26	0.27	0.031	0.006	0.0085	-	-	残
	9	27.85	1.03	0.25	0.32	0.027	0.007	0.0059	-	-	残
	10	34.12	0.92	0.25	0.29	0.029	0.010	0.0038	-	-	残

[0024]
[Table 2]

種別	成分組成（重量%）									
	Zn	Ni	Si	Sn	Fe	P	Mg	Ca	Pb	Cuおよび不可避不純物
本発明コネクタ素材 11	6.53	1.06	0.26	0.32	0.030	0.003	-	0.0013	-	残
12	12.18	1.02	0.26	0.27	0.028	0.005	-	0.0281	-	残
13	6.62	0.97	0.25	0.32	0.034	0.010	-	0.0353	-	残
14	6.18	0.98	0.26	0.31	0.023	0.005	-	0.0497	-	残
15	6.28	1.04	0.26	0.28	0.028	0.003	0.0042	0.0035	-	残
16	6.63	0.97	0.25	0.32	0.028	0.011	0.015	0.0011	-	残
17	6.67	1.10	0.26	0.29	0.030	0.003	0.0031	-	0.0093	残
18	6.54	1.07	0.25	0.28	0.028	0.008	-	0.0021	0.0039	残
19	6.71	1.02	0.25	0.31	0.032	0.005	0.0023	0.0011	0.0057	残

[0025]

[Table 3]

種別		成分組成（重量%）									
		Zn	Ni	Si	Sn	Fe	P	Mg	Ca	Pb	Cuおよび不可避不純物
比較コネクタ素材	1	36.5*	1.05	0.26	0.18	0.083	0.075	0.0032	-	-	残
	2	5.3	3.21*	1.08*	0.48	0.055	0.011	0.0036	-	-	残
	3	4.8	1.21	0.26	0.46	0.057	0.2151*	0.0032	-	-	残
	4	0.73	1.87	0.47	0.48	0.025	0.005	0.2350*	-	-	残
	5	6.72	1.03	0.24	0.31	0.026	0.009	-	0.0610*	-	残
	6	6.58	0.99	0.26	0.30	0.031	0.005	0.0030	-	0.012*	残
	7	6.98	0.62	0.18	0.55	0.148	0.083	0.0007*	-	-	残
	8	6.52	1.04	0.26	0.27	0.029	0.004	-	0.0005*	-	残
従来コネクタ素材		0.95	2.03	0.49	0.52	0.037	0.012	-	-	-	残

（*印は、この発明の条件から外れている値を示す）

[0026]

[Table 4]

種別		素材製造時の熱延性		はんだぬれ性	曲げ部のメッキ剥離の有無	打抜き加工による金型摩耗の平均変化率の相対比（従来コネクタ素材を1とした）	Snメッキの加熱による黒変色の有無	備考
		5mm以上の長さの割れの発生数（個）	最大割れ長さ（mm）					
本発明コネクタ素材	1	0	0	良	無	0.48	無	−
	2	0	0	良	無	0.60	無	−
	3	0	0	良	無	0.60	無	−
	4	0	0	良	無	0.59	無	−
	5	0	0	良	無	0.60	無	−
	6	0	0	良	無	0.58	無	−
	7	0	0	良	無	0.60	無	−
	8	0	0	良	無	0.57	無	−
	9	0	0	良	無	0.56	無	−
	10	0	0	良	無	0.56	無	−

[0027]
[Table 5]

種別		素材製造時の熱延性		はんだぬれ性	曲げ部のメッキ剥離の有無	打抜き加工による金型摩耗の平均変化率の相対比（従来コネクタ素材を1とした）	Snメッキの加熱による黒変色の有無	備考
		5mm以上の長さの割れの発生数（個）	最大割れ長さ（mm）					
本発明コネクタ素材	11	0	0	良	無	0.68	無	−
	12	0	0	良	無	0.57	無	−
	13	0	0	良	無	0.57	無	−
	14	0	0	良	無	0.55	無	−
	15	0	0	良	無	0.58	無	−
	16	0	0	良	無	0.57	無	−
	17	0	0	良	無	0.48	無	−
	18	0	0	良	無	0.53	無	−
	19	0	0	良	無	0.51	無	−

[0028]
[Table 6]

種別		素材製造時の熱延性		はんだぬれ性	曲げ部のメッキ剥離の有無	打抜き加工による金型摩耗の平均変化率の相対比（従来コネクタ素材を1とした）	Snメッキの加熱による黒変色の有無	備考
		5mm以上の長さの割れの発生数（個）	最大割れ長さ（mm）					
比較コネクタ素材	1	0	0	良	無	0.59	無	冷間圧延工程で耳割れ発生。コネクタ素材として信頼性低い。
	2	3	20	良	有	0.62	無	-
	3	3	25	良	有	0.61	無	-
	4	2	20	良	無	0.52	有	-
	5	2	15	良	無	0.53	無	-
	6	5	45	良	無	0.47	無	-
	7	5	20	不良	無	0.90	無	-
	8	3	15	不良	無	0.88	無	-
従来コネクタ素材		7	45	良	無	1.00	有	-

[0029]

[Effect of the Invention] From the result shown in Table 1 - 6, if Zn is conventionally added exceeding 3% in a connector raw material, it is said that soldering nature falls, but Zn contains exceeding 3%. ** Mg: 0.001-0.2% and Ca : this invention connector raw materials 1-19 containing 1 of 0.001 to 0.05% of sorts and two sorts do not have lowering of soldering nature. Moreover, hot working nature can improve by adding Mg and Ca, a plate can be manufactured with the sufficient yield, and it turns out that a black discoloration color is not carried out even if Sn plating of the connector produced using this connector raw material is under hot environments.

[0030] On the other hand, the comparison connector raw materials 1-8 of composition and the conventional connector raw material which separated from the conditions of this invention, The crack development at the time of hot-rolling, poor soldering nature, the black discoloration color of Sn

plating under high temperature, The place where buildup of exfoliation and the metallic mold wear at the time of stamping and at least one characteristics which are shown in a remarks column, and which are not desirable in addition to this appear shows that a connector reliable even if it produces a connector using a connector raw material these comparison connector raw materials 1-8 and conventionally is not obtained.

[0031] In addition, it is since the pull strength of this invention connector raw materials 1-19 and the comparison connector raw materials 1-8 and stretch were almost equivalent to the connector raw material conventionally although measured about the pull strength and elongation of the connector raw material, respectively this invention connector raw materials 1-19, the comparison connector raw materials 1-8, and conventionally. What is indicated to Table 4 - 6 was omitted.

[0032] As mentioned above, the connector for electrical and electric equipment by which soldering nature is not spoiled even if it adds Zn exceeding 3%, in order to prevent discoloration of Sn plating under high temperature can be offered, and it can contribute to development of electric electronic industry dramatically.

[Translation done.]